

EXTENDED PRECISE SPECTROSCOPY OF THE ν_3 BAND OF METHANE

HIROYUKI SASADA, SHO OKUBO, HAJIME INABA, *National Metrology Institute of Japan (NMIJ), National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan.*

We measured transition frequencies of the ν_3 fundamental band transitions of methane from P(1) to P(12), from Q(1) to Q(14), and R(0) to R(8) with an uncertainty from a few to seventeen kilohertz using a difference-frequency-generation source, an enhanced-cavity absorption cell, and an optical frequency comb.^{a,b} This paper presents that the tunable range and the power level of the spectrometer has increased and that 37 allowed and 39 forbidden transition frequencies of R(4) to R(12) have been precisely measured. The forbidden transitions have allowed us to determine precise combination differences of the ground state. We have improved molecular constants of the ground state from the combination differences of the present work and Refs *a* and *b* together with the previous few microwave measurements. They reproduce the measured frequencies with an unweighted standard deviation of less than 20 kHz, which is as small as polar molecules microwave spectroscopy is applicable to.

^aS. Okubo, H. Nakayama, K. Iwakuni, H. Inaba, and H. Sasada, *Opt. Express*, vol. 19, p. 23878 (2011).

^bM. Abe, K. Iwakuni, S. Okubo, and H. Sasada, *J. Opt. Soc. Am. B*, vol. 30, p. 1027 (2013).